sense, of every other single criterion which could be applied.

These, however, are small points. Summing up one's impressions of the book as a whole, they are that it well maintains its place in the front rank of works devoted to the study of oils, fats, and waxes. To the chemical technologist it is practically indispensable.

C. SIMMONDS.

A CYTOLOGICAL TREATISE.

Plasma und Zelle. Erster Abtheilung. By Prof. Martin Heidenhain. Erste Lieferung, Die Grundlagen des mikroscopischen Anatomie, die Kerne, die Centren, und die Granulalehre. Pp. viii+506. (Jena: Gustav Fischer, 1907.) Price 20 marks.

THIS somewhat bulky volume is the first instalment of Prof. Martin Heidenhain's treatise on "Plasma und Zelle" which is to form a part of Bardeleben's great work on human anatomy.

The method which the author has adopted is perhaps not the ideal one, but it must be remembered that the science of cytology is young, and its vigorous development has manifested itself in the growth of an enormous amount of details which some day will become connected up so as to make a coherent organism, despite the fact that at the present time the different sections seem to be somewhat isolated. The features which in one group appear to be of fundamental importance may elude recognition in, and perhaps be really absent from, others; and thus that logical connection so dear to the minds of many is difficult, and at present often impossible, to trace. Probably for some time to come the trees will be more apparent than the wood. Prof. Heidenhain has chiefly worked on the cells of a few vertebrate animals, and it must be confessed that throughout the somewhat lengthy treatment of his subject this point of view is rather strongly reflected. There is hypothesis in plenty, together with much really acute analysis, but one cannot repress the feeling that the chastening influence of the protozoan nucleus is rather conspicuous by its absence.

The treatment is frankly morphological, and upon a somewhat narrow range of very detailed observation of comparatively few forms a theoretical superstructure of doubtful stability has been erected. Some cytologists, at any rate, will criticise one of the earlier pronouncements (p. 3) in the book, to the effect that discussion (Erörterung) of biochemical structure forms no part of the province of scientific morphology, and that the latter must take the former as granted. Surely the trend of modern morphology is in the direction of discontent with such a position. Some of us, at any rate, believe that form and structure are merely the expression of biochemical constitution, and it is just this latter problem that we want to attack.

Prof. Heidenhain postulates "units of living substance" as the essential elements of an organism. The cells are regarded as a special case of the aggregation of these living units. In this he is practically following those who regard the cell as by no means the real unit of the organism, and unquestionably this is a tenable position; but, nevertheless, the cell, despite its complex organisation, represents actually the lowest rank in the polity of the multicellular organism out of which the organism itself is built up; nor is the case really different in syncytial bodies. The quarrel with the cell from this point of view is perhaps partly due to the fact that we have not been clear as to what we mean by an organism. A human society is made up of the individuals which compose it; we are justified in regarding them as the ultimate constituents of such a social organism and we cannot usefully push our analysis further back, for they form the lowest units which propagate themselves and differentiate into the complex structure of which the society is composed. Of course, we are aware that each one can be resolved still further into tissues and cells, but these things do not come into the scheme of the social organism as such. The same holds good when we get still lower in the scale. The cells plainly continue to be the units of which the *corpus* is built up—until we get to the unicellular organisms. In the latter we find a more elaborate differentiation than is characteristic of the metazoan or metaphytan cell, but in essentials it seems to be the same. The protoplasm and the nucleus still are requisite to maintain it as a going concern, and reproduction by fission or otherwise is always connected with the distribution of a combination of both to each of the offspring. This is strikingly shown in some forms in which a nucleus as such is perhaps absent, and only the stuff of which the nucleus is made is present in a more or less distributed condition in the cell.

But although we may not agree with the author in his belittlement of the cell, many will assent to his conclusion that it has been made too prominent as the "be all and end all" of the living body. The organism is higher than its parts, and itself determines what form it shall take—or, to put it more plainly, the reactions that are due to the relations subsisting between one part of the organism and another, or between it and its environment, are of such a kind as to influence the fashion of development of the new cells and new tissues.

Prof. Heidenhain's position with regard to the cell is clearly stated on p. 81, where he says that

> "it is not the cell which is the bearer of life, but life is inherent in every living particle, down to the smallest molecular group which can be called alive. The cell is rather only a special apparatus which itself is made up of living material."

The crux of the matter obviously lies in the meaning we attach to the word "living."

Many pages are devoted to cell organs, such as centrosomes, and to a very lengthy discussion of Altmann's so-called "granular theory." We confess that much of the space thus allocated seems to us to be hardly well utilised; and although it is not fair finally to criticise a work of which only the first part has appeared, it appears to us that a more real service to cytology would have been rendered if Prof. Heidenhain had focussed the information which is so rapidly accumulating as the result of the study of the lower forms of life upon the problems presented by the higher types.

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But he has, at all events, laid those who are interested in cytological development under a debt of gratitude by the exhaustive treatment he has accorded to those topics which he decided to discuss.

MARINE PROPELLERS.

The Screw Propeller: and other Competing Instruments for Marine Propulsion. By A. E. Seaton. Pp. xii+255. (London: Charles Griffin and Co., Ltd., 1909.) Price 12*s.* 6*d.* net.

THE author of this book is well known, both as a practising marine engineer and as an author. His "Manual of Marine Engineering" has long served as a text-book, and has passed through many editions. It was natural, therefore, that the announcement of a work by Mr. Seaton dealing with marine propellers should awaken interest over a wide circle of readers, more especially as the problem of propeller design has not yet received a complete solution. As Mr. Seaton says, "even in modern times . . . . our best men do sometimes fail to achieve success," although there are now available the results of much experimental and theoretical investigation on the subject. After seventy years' continuous work it still remains true that when novel types of ships or unprecedented speeds have to be attempted, although use may have been made of all available data, and the best advice taken, full success is not always or at once achieved. On the contrary, considerable gains in efficiency are frequently attained by a process of "trial and error," out of which comes a final selection of the propeller forms and dimensions best suited to novel conditions.

Such a confession may be thought discreditable; indeed, it is sometimes so treated by critics who have not themselves had occasion to undertake responsibility for ship and propeller designs; but it represents the facts of the case, and the explanation is not far to seek. When a problem has been unsuccessfully attacked by men like Rankine and William Froude, amongst those who have finished their work, and by men like R. E. Froude, Cotterill, Greenhill, and D. W. Taylor, who are still alive and interested in finding solutions, it may be presumed that the problem involves considerable difficulties. When one considers the almost endless variety of the conditions involved in ship propulsion, the failure to reach a complete solution of the problem need not cause astonishment, and it is reasonable to anticipate that we shall have to be content for some time to come, if not permanently, with partial solutions chiefly based on experimental investigations, and on careful scientific analyses of the results.

Mr. Seaton definitely states in his preface that the

"object of the present work is to amplify and extend what [had been given] in skeleton or in rudimentary form" (in his "Manual of Marine Engineering") in the shape of rules for guidance in the practical work of designing propellers. These rules are said to have been "generally based on scientific reasons and always capable of giving results agreeable with the best and most successful practice": and it is claimed that by means of successive improvements "they have become generally applicable to the design of a screw for an Atlantic liner or a torpedo boat." It is added that "the more abstruse and highly mathematical investigations connected with the theory of the resistance of ships and propellers have been left to be studied in the text-books and . . . . valuable papers" of various authors.

More or less empirical rules such as Mr. Seaton proposes no doubt have a certain value as representing his own practice and deductions from his study of published results of steamship trials, but it cannot be admitted that such rules can be depended upon absolutely when new conditions have to be faced. If it were true that the best results could be ensured by the use of any known rules in the designs of screws over the wide range from "an Atlantic liner to a torpedo boat," difficulties such as have been mentioned would disappear, and the work of the naval architect would become easy of performance. The occurrence of these difficulties demonstrates the imperfection of existing rules.

Turning to the general scheme of the book, it may be said that the section dealing with the history of marine propellers is both interesting and valuable. Bourne's book, giving the early history of the screw propeller, is not now generally accessible, and Mr. Seaton's summary will be found useful for reference. Paddle wheels, screws, and hydraulic (or jet) propellers are treated separately, their principles of action are explained, rules being given for their practical design. One chapter is devoted to an explanation, in popular language, of the modern theory of the resistance of water to the motion of ships, but readers desiring full information on the subject will necessarily have to turn to other sources, as Mr. Seaton only attempts a brief sketch. Naturally, screw propellers claim most attention, their various forms, numbers and positions are described; and the effects of changes in numbers, shape, and proportions of blades are also discussed at some length. Much information has been collected and collated respecting experimental trials made with screw propellers, but it seems doubtful whether the large amount of space devoted to trials made by the Admiralty and other experimentalists in the early period of screw propulsion might not have been better utilised, seeing that these trials were made on ships the forms, proportions, and speeds of which in no way represent present practice, while many important conditions affecting results are not definitely known. An antiquarian interest attaches to them, and from their consideration certain useful deductions may be, and, indeed, have been, made; but radical differences exist between conditions prevailing thirty or forty years ago and those of the present day, and the devotion of much time to this subject, when better and later information is available, is not desirable. The chapters dealing with the geometry of the screw and materials used in the construction of the screw propeller are excellent.

The book is well produced and illustrated. It has an excellent index, and as a work of reference will be found of service to all interested in the propulsion of ships.

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